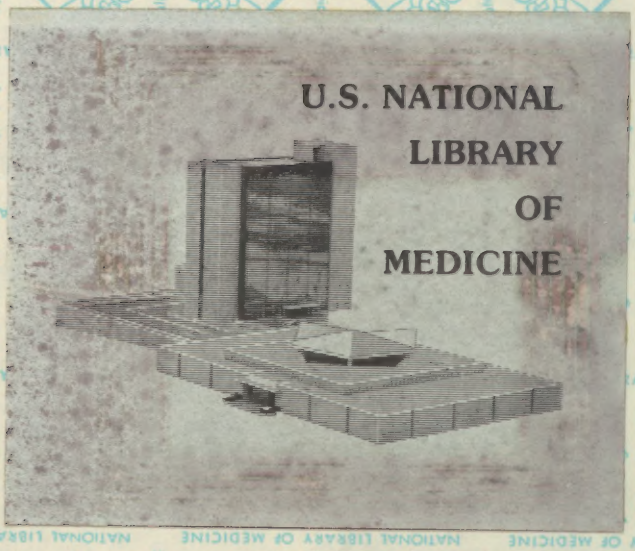


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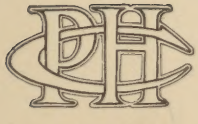
The Human Body and its Care

(Copyr'ght by J. S. Engs)
Vertical Section of Human Skin many times magnified
Photomicrograph

THE HUMAN BODY AND ITS CARE

BY

JOHN S. ENGS D. D. S.



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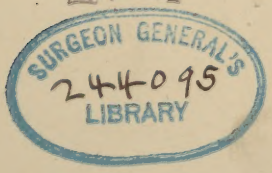


INTRODUCTION.

"In man or woman, a clean, strong, firm-fibred body is more beautiful than the most facinating face." To insure this, we should give special attention to the growing child's nutrition and to his hygiene, both of body and mind, during the school period.

The conditions necessary to insure healthy nutrition of any part of the body are:

1. A sufficient supply of blood; 2. A good quality of blood; 3. A supply of nerve force; 4. Functioning exercise; 5. Due intervals of rest.

Nourishing food makes blood, muscle and bone. Blood carries food and oxygen to all parts of the body and brings away waste (used up material). Exercise accelerates the flow of blood, and together with deep breathing, insures a supply of oxygen. Oxygen stimulates growth and facilitates the removal of waste material from all parts of the body. Hence, we should eat proper food, take regular daily exercise and practice deep breathing where there is plenty of fresh pure air.

During the past few years certain food elements have been given a prominent place in all discussions regarding the physical and nutritional welfare of our bodies; they are called vitamines; are rather difficult to define and are known by the letters A. B. C. Some are soluable in fat and some in water. The most important ones are found in butter-fat, egg-yolk, codliver-oil, cabbage, greens, vegetables, milk, berries, and fruits.

If the suggestions offered in this book are followed, observing due care in the matter of eating, sleeping and exercise, our little ones will grow up with strong well nourished bodies that will not yield readily to disease agents.

PREFACE.

This little work owes its inception to a remark made by a teacher, one of my patients, that she was using a little booklet of mine, called "Food Talks with the Children," in her classes in Nature Study. I said I did not think there could be much material in that to help her. She replied, "Well, it is all I have; there is no text-book that I know of dealing with the subject in a style suitable for children." It appears, therefore, that there is a need for some such work, so I have tried to bring together just enough material to familiarize the child with the various parts of the human body; to learn the uses for which its various structures are intended and the actions of its vital organs, so that he may know their relation to one another, and the dependence of bodily health upon proper functional activity in every part.

"The old order changes"—We no longer look upon our doctor and our dentist as creatures of last resort, to be avoided if possible: the first a dispenser of nauseous draughts; the other a wielder of instruments of torture, for their methods have changed.

They aim now to prevent disease, rather than to try to cure it, thus checking much consequent loss of tissue, and weakening of the body. Having the welfare of our patients at heart, we know of no better way to insure health than by teaching people what the requirements of the body are, and how they may be met. It is with that object in view that I respectfully offer this little book to the public,—especially for the use of our younger readers.

If my little contribution to the subject shall be the means of creating an interest in young minds and stimulating them to further study of that wonderful organism, the human body, it will afford sincere gratification to

THE AUTHOR.

The Human Body and its Care

CHAPTER I.

If we were to ask the average person what food is, he would probably say, "food is what we eat to satisfy our hunger," and in one sense that is true, but it is not a good definition of food; for the things we eat should do more than satisfy our hunger.

A true food contains nutrients—from which are derived building-material for growth, and also to repair parts that are worn through usage, energy for muscular and nervous activities and heat to keep the body warm.

It is from food-materials, such as vegetables, meat, fish, milk, eggs, grains, etc., that we derive those nutrients that go to make muscle, blood, skin and the other tissues of the body, and also the organic salts that enter into the composition of bones and teeth, and promote various functional activities of the body. From the starchy foods and sugars called carbo-hydrates, and the fats, we derive only energy and heat. For that reason an individual engaged in hard manual labor, or a rapidly growing child, would naturally require food of different character from one leading an inactive life, or who had completed his growth. This should be taken under consideration when planning our daily meals.

For a number of years, several very learned men in different parts of the world,—some in Japan, some in Europe and some in the United States,—have been feeding men and animals upon different kinds of food to find out what effect it had upon their bodies; and to find out if some foods were better than others.

As a result of their experiments, they are satis-

fied that everything we eat has an effect upon us, either for good or for bad. If the things we eat contain nutrients, that is, things that our bodies need to make bone, teeth, skin and the like, and furnish material to repair parts of the body that become worn down by work, and also energy or working power for our bodies, all will be well with us.

On the other hand, if the food we eat does not contain these things, the body will be undeveloped and weak in some parts. Who can tell how far that weakness may effect the whole body? Suppose it should be in the bones that form the framework or skeleton of our bodies. Every bone in that frame-work has some particular office to perform. Each bone was very carefully designed by an all knowing Creator for a particular purpose. Some like the ribs, form a sort of roof over the delicate internal organs; they shield the lungs and heart from injury that they might receive from outside pressure. If a lot of us were all crowded together in a narrow hallway or room, we would not be able to breathe were it not for our ribs. The leg and back bones support our bodies when we are standing and walking or running, and furnish attachments for the muscles that enable us to move about. So we see that it is very important that the bones should be strong.

Some of these men of science that we have spoken of, fed animals on special food to find out what would happen if the food contained very little lime and other salts that are necessary to make good bones and strong teeth. At one time they fed such foods to pigeons, and after the birds had grown up they found that some of their bones were very thin, and others full of holes. In another instance, they took a family of little puppy dogs. To half of them they fed meat, and gave bones and pieces of fat also. These grew up to be strong big dogs. The others they gave only meat and fat to eat; and the poor dogs getting no bone which con-

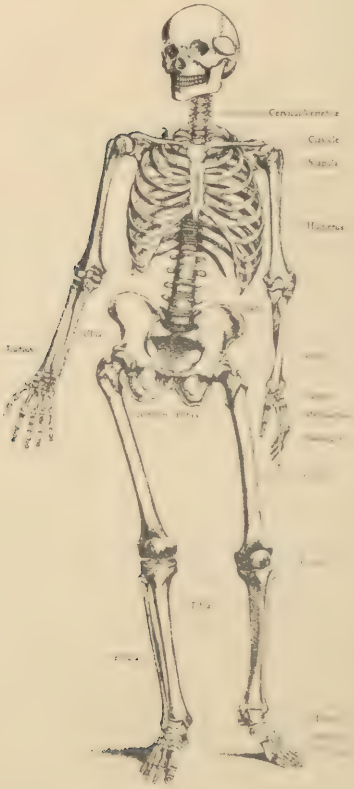
tain; the lime, phosphorus and magnesium necessary to harden their bones, grew up with weak, soft leg bones and poor jaws and teeth. They couldn't stand and run about, for their legs were too weak to support them.

BONES, LIGAMENTS AND TENDONS.

Bones form the frame-work, or skeleton of our bodies, and furnish attachments for the muscles; they are held together by ligaments and the muscles are attached to them by tendons.

The lower jaw, or mandible, as it is called, is movable. The upper jaw is not movable. We grind our food by moving the teeth in the lower jaw against those in the upper. The lower jaw fits in a socket provided for it just in front of the opening into the middle ear, and is held in place by ligaments. It is moved up and down, sideways and backwards and forwards by muscles. The muscles that move the arms and legs, are fastened at one end to some part that doesn't move, and at the other to the part that is moved by tendons.

Once upon a time, there was a very great soldier in Greece whose name was Achilles. In those days they used swords, spears, slings and bows and arrows to fight with, To protect themselves from these in the hand of their enemies, they wore armor and carried large sheilds. The armor had many joints in it, and Archilles' mother was afraid that when he grew up to be a man and went to war, a weapon might penetrate one of them and kill him. So she tried to find some way to protect him. One day somebody told her that if she would dip him in a certain river, no part that the water touched could be cut by a sword, or stabbed by spear or arrow. So she took him to the river, but when she got him there, she was afraid that if she held him by the hand, or the ear, or the nose, or the feet, that he might be shot by an arrow just at the place where



The Skeleton (*after Hollen*)

The Human Skeleton

she held him, and she didn't dare let go of him altogether for fear that he might be drowned. So in order that the very smallest part of his body only should escape the water, she held him by the tips of her thumb and finger just above the heel of one of his feet; then she dipped him in the river. When he grew up, although he was always in the thickest of the fight, he never was injured because he always faced the enemy. One day, however, somebody got mad at him, and told the secret of the little place above his heel, and they aimed a poisoned arrow at this spot and killed poor Archilles. If you feel the place, you will find a tough cord that is attached to a big muscle in the back of the leg below the knee. It is named the tendon of Archilles.

MUSCLES.

The big muscle that this is attached to, forms what we call the calf of the leg. When this muscle works, it raises us on our toes and helps us to spring forward in running. In some parts of the world, the hunters of wild animals creep up softly behind them and cut the tendon so that they cannot run away, and then it is very easy to kill them.

There are two kinds of muscles, one called voluntary, that works when we want them to, and the other called **involuntary,** that go right on working all the time, while we are alive.

All the muscles of the body are of the first kind, with the exception of those of the heart, stomach, and some of the internal organs.

There are muscles all over the body. Some in the arms, back and shoulders, we use in lifting things; others, around and between the ribs, we use in breathing. Attached to the head and jaws, are muscles that move the jaw in chewing our food, and we should be very careful to use these as much as we can when eating our meals, for the better we chew our food, the more good we will get from it.

Muscles (*after Brubaker*).

The Muscles of the Human Body

CHAPTER II.

THE TEETH.

The teeth of animals are numbered amongst the most important organs of the body, and while civilized man uses his teeth mainly to prepare food for reception into the stomach, many of the lower animals find in them also their principal means of defense and attack against an enemy.

Birds and Mammals belong to the two highest divisions of the animal kingdom.

Birds of the present day have no teeth, but almost all mammals have two sets, a temporary and a permanent.

The principal characteristic of mammals is that they furnish milk for their young.

There are many different kinds of mammals, ranging from animals of great size to some so small that several may be held in the palm of the hand.

Elephants are examples of the largest; mice and bats of the smallest mammals.

Most of them live on land, but the very largest of all, the whale, lives in the deep sea. Many people think because whales live in the sea, and have flippers and a tail, that they are fish, but they are not. It is believed that many years ago (before man lived upon the earth) whales had legs and walked about on land and in the rivers until other animals preyed upon them, and drove them farther and farther away from the shore.

Now, if we could dive down into the ocean where the whales live, we might see the little baby whales swimming along with their mothers taking their food when hungry, just as the little kittens and puppies do.

In order that food material may serve the needs of the body, it must be in such form as to be taken up or assimilated. As compared with its bulk, the nutritious portion of most food is small, and before it may be available for use in the various parts of the body where it is needed, it must be separated from the rest of the food material by a process called digestion. The first step in this process of separation is to break up the food into small particles that may be swallawed. This office is performed by the teeth, and in some instances it is all that is required of them.

But the food of human animals, particularly that taken by growing boys and girls, should receive more attention from the teeth than that. Not only is it necessary that their food should be cut up, but it should also be ground up.

The different shaped teeth are adapted to the preparation of different kinds of food. The permanent set has in front of the molars eight teeth called bicuspids or pre-molars. They have some similarity in form to the teeth of dogs and wolves, and together with the canine or eye teeth prepare meat and other animal food. Muscle fiber, fat and connective-tissue is cut, but not ground.

While chewing, the tongue carries vegetable food back to the molars where it is ground, thus breaking up the covering over the more nourishing parts. Many foods, such as mushes, should be masticated to insure thorough admixture with saliva, not because they need to be made fine. This is particularly true of starch foods, such as bread and crackers. Something that is in the saliva acts upon the starch in bread, mush and vegetables, and changes it into a sort of soluble sugar. Nearly 24 per cent. of the white bread after being chewed in the mouth, is, in one minute, changed to sugar; and over 1-3 or 39 per cent. is changed in five minutes. After food is swallowed, the conversion of thoroughly insalivated starch into sugar, goes on in the

Typical Teeth of the Carnivoræ, the Herbivoræ, and the Omnivoræ

stomach for ten or twenty minutes; or until it is arrested by the action of the stomach acids. This proves the great importance of thoroughly chewing all foods containing starch.

When dry food is thoroughly wet with saliva, we have no difficulty in swallowing it, but some people find chewing too slow a process, so they resort to the use of liquids at meals to hurry up the wetting process. That is very bad practice, for the time of exposure to the action of saliva is lessened, and the first step in the process of digestion is checked, resulting in a loss of 20 per cent. to them in the value of their vegetable food.

Animals of the dog and cat type are called carnivorous (flesh eating) and in the wild state confine themselves strictly to that kind of food; though under domestication they may be taught to eat other things. Nature seems to have intended that kind of food for them, as their teeth are perfectly adapted to tearing and cutting flesh and crushing bones. In the mouths of horses, cows and other animals called Herbivorous (herb eating) we find another kind of teeth with broad flat surface having fissures at intervals thus making them good millstones, so that it is quite evident that grasses and grains are foods specially intended for them.

With man, however, we find a different state of things. His teeth are neither like the teeth of dogs nor like those of cattle, but are modifications of both types. They may be used either for cutting, tearing or grinding as the food may require. It is thus evident that he is by nature omnivorous (one who feeds upon both meat, vegetables and fruits) and should regulate his diet accordingly.

Man, the human animal, has two sets of teeth. The first set, called deciduous or milk teeth, number twenty teeth; ten in each jaw. They make their appearance in the jaws at various ages, ranging from the fifth to the seventh month for the central incisors; to the 20th or 36th month for the second

molars. Their periods of eruptions are about as follows:-

The four central incisors	5 to 7 months
The four lateral incisors	6 to 10 months
The four first molars	11 to 16 months
The four canines	14 to 21 months
The four second molars	20 to 36 months

At about the sixth year, the permanent teeth begin to put in an appearance. The first to come are the sixth year molars. They occupy a position just behind the second molars of the milk set, and are often mistaken for temporary teeth because they do not replace others lost from that set.

Then follow, at various ages, the other teeth of the permanent set, until the wisdom teeth or third molars take their places in the jaw, thus completing the set of thirty-two teeth, somewhere between the 18th and the 25th year.

A good set of teeth depends upon an abundant and continuous supply of proper building material while the teeth are developing, and unfailing attention upon the part of the individual in caring for the teeth after they have erupted. The first may be insured by eating proper foods, and the last by constant, daily use of the tooth-brush, and a proper dentifrice, together with a little common-sense in eating and drinking, i.e., the avoidance of excessive amounts of candy, white bread and cake, and the substitution for them of cooked and uncooked vegetables and fresh fruits.

The teeth should be carefully brushed at least twice a day (morning and night) and receive attention from the dentist at regular intervals during the year.

CHAPTER III.

THE HEART.

The heart is a pump that sends blood to every part of the body, and never stops working completely until we are dead.

It pumps dark-colored blood, that is full of poisonous substances gathered from all parts of the body, into the lungs. Some of these are got rid of when we breathe out, or exhale. When we breathe pure air into the lungs, oxygen from the air is mixed with the blood and held by little discs floating in it that look like little red "Tiddledewinks," but they are so small that we cannot see them with the naked eye. They are called red blood corpuscles. After oxygen is mixed with the dark blood, it becomes bright red in color and flows back to the heart to be again pumped out through another set of tubes or pipes called arteries, that branch out again and again from the main ones, becoming smaller and smaller, just like the branches of a tree, until finally they become little twigs, called capillaries, that can only be seen with a powerful microscope. Through these little twigs the food material passes out, and the waste material is collected. The blood then passes through another set of capillaries that are joined with the veins, and then into the veins themselves.

The arteries send branches to every muscle and to every organ of the body. After food is swallowed it goes to the stomach and from that it passes through the intestines, where the process of digestion is completed, and the good parts made ready to be taken into our bodies, to make bone, flesh, blood, nerve, brain-matter, etc. When the blood is pump-

Scheme of Systemic Circulation (*after Bundy*)

Sketch Showing the Blood Circulation of the Human Body

ed to the intestines, it gathers up some of this prepared food and carries it along with it. The rest, and probobly the biggest part of the prepared food, containing the body building material, is in the form of a milk like fluid. This is gathered up by minute tubes called lacteals.

LYMPHATICS.

Besides the blood tubes there is another set called lymphatics. They are found in all parts of the body, but are in greatest numbers in the neck, the arm pits, around the elbow joint and in the abdomen. Those in the abdomen collect the food milk. Lac means milk in one language, and for that reason those around the intestines are called lac-teals. They carry it to larger vessels that empty into a pipe called the thoracic duct. This passes up to the level of the shoulder and empties its contents into one of the veins, where it mixes with the blood.

The blood flows along to every muscle and to every organ of the body giving to each portions of this prepared food. To the bones it gives phosphorus, lime and magnesia that is furnished by food material such as whole grains, vegetables, eggs, milk, milk products and fruits; to the muscles, blood, and other tissues it gives nitrogenous substances, also found in grains, milk milk products, eggs and in fish meat, beans, peas, etc.; to the brain and nerves, phosphates and other things from the same sources. It adds to the supply of fluids in some parts of the body, and where there is too much fluid, takes some away.

When breadstuffs, sugar or fat are consumed in our bodies, and when we exercise our muscles in working or in play, heat is produced or generated. This heat is a product of combustion and is similar to the heat produced through the burning of wood or coal. It is thus that the body is kept warm, just as a fire warms us. A lot of material, called waste,

is formed in the body whenever heat is produced, just as the ashes are left after a fire, and these must be removed. The removal of waste from the body depends upon the combustion being complete. Oxygen accelerates it. So we should practice deep breathing in order that the blood may take up lots of oxygen. After this burning up process is completed, the blood gathers up the waste matter and carries it along, together with the remaining oxygen and body building material. Later on, when we tell about the liver we shall see how the blood gets rid of this waste.

ARTERIES AND VEINS.

The tubes that carry blood are of two kinds—arteries, that carry blood away from the heart, and veins, that carry blood toward the heart.

CAPILLARIES.

When the arteries reach the part that they carry blood to, they branch out into smaller arteries and then into very minute tubes, called capillaries. It is these capillaries that bleed when we scratch our fingers. The blood that flows through the arteries is bright red, but after it passes through the capillaries and leaves food material to a given part and gathers up the waste material, it turns very dark red and is called venous blood. When it is like that it flows back into the heart again, to be once more made bright red by being pumped again into the lungs.

THE LIVER.

After the blood has circulated through the walls of the stomach, intestines, and several other internal organs, it passes onward and through a tube called the portal vein that conveys it to the liver. The

liver is one of the largest organs in the body. It is situated on the right side below the lungs.

It was once thought that the only thing it did was to make or secret bile. Sometimes when we had been eating too much and felt sick at the stomach, had headache and felt pretty bad all over, we called it a billious attack and thought the liver had grown lazy and needed stirring up. But now we know better. The poor liver wasn't to blame; the trouble came from working it too hard. The principal work of the liver is to change the nature of the poisons and waste products formed in our bodies, and to secret bile. It does several other things besides that are pretty hard to explain; so we will just tell about the poisons and the bile. We spoke of the poisons collected by the blood. Some of them are swallowed with the food we eat; some are formed by little organisms called bacteria that cause disease and also putrefactions in the intestines and others result from changes going on constantly in the body.

It all of these poisons were allowed to remain in the blood, we would soon take sick and die. But the liver looks out for that. When the blood flows through it, it catches the poisons and by help of the oxygen changes them into other substances, that are carried away in bile, sweat, the discharge from the mucous membrane, and in other ways. Besides carrying away with it some of the waste matter, the bile assists in the digestion of the fat we eat, and in some way seems to check putrefactions in the intestinal canal. So we see that the liver is a very important, hard working organ. We can overwork it and make ourselves sick, by eating too much candy, cake, cookies, pie, or even too much bread and butter; or we can help it and give it a rest, by change of diet and moderate eating, with plenty of fresh fruit and vegetables.

KIDNEYS.

As we have seen, poisons and waste products that have been changed by the liver into different forms are got rid of by the lungs, the skin, and mucus membane of the mouth, and by being carried away in the bile. But by far the greater part of the waste material, resulting from the breaking down and building up of flesh and bone that is constantly going on in our bodies, is filtered out, together with the waste-water of the blood, when it passes through the kidneys.

CHAPTER IV.

SKIN.

The skin of our bodies is a very wonderful thing; it serves not alone as a covering, that sheilds the delicate tissues below from the attacks of disease producing germs, but possesses the sense of touch, helps to rid the body of many of its waste products, and also controls the temperature of the body. It is composed of two layers. The under layer or true-skin, when seen under the microscope looks rough, very much like the surface of the tongue. The little points that we see are called papillae. They contain minute blood-vessels called capillaries (that we mentioned before) and little nerve ends which catch the impression of touch.

Imbedded in the tissues at the lower border of the skin are little bundles of twisted tubes called sweat glands. From them, in wavy lines, tubes extend to the surface of the skin and end in what we call the pores. (See Plate 1.) These tubes carry moisture and waste products dissolved in this moisture to the surface. When we work hard or play hard on a hot day, this moisture fairly drips from the surface of the skin and thus keeps the body cool. It is very dangerous to allow the pores to become stopped up in any way, for then the blood becomes over-heated.

Many years ago in Italy, one of the reigning nobles gave a magnificent street parade to the people. There were floats of many kinds; on one of them was a beautiful boy covered from head to foot with Gold leaf. He represented the Golden Age, and was as happy and merry as could be. But the next day the poor boy was taken sick and

died. I am told that the same thing occured after a grand street parade in San Francisco, in which a woman appeared with the upper part of her body

Cross Section of Human Scalp Many Times Magnified
Photomicrograph

bronzed. In both instances, the indirect cause of death was closure of the pores of the skin. When the little tubes that end in the pores are examined

with a powerful microscope, they look as a great doctor once said, "like the intestines of a fairy." They are seen very clearly in Plate VI., which shows a section (horizontal) of human scalp magnified many times.

The little worm like twisted things are portions of the sweat glands lying deep down in the skin, from them a straighter tube goes to the surface.

The larger rings are cross sections of the hair roots. The black portion in the center is the hair itself.

Hair grows from the skin covering the entire surface of the body with a few exceptions, such as the palms of the hands and the soles of the feet. Some hair is so fine, that it is like the down on a peach and not seen readily, but on top of the head it grows very thick and very long.

EPITHELIUM

The outer portion of the skin is called the cuticle, its under layer (in contact with the papillae of the true-skin) consists of columnar-cells packed closely together, which grow from below, constantly forcing the older ones outward. These gradually change shape, becoming more and more flattened as they approach the surface, where as dead cells they either fall or are rubbed off. In some places where the growth of cells is very active, horny layers called calluses are formed by the rapid accumulation of the dead cells.

The skin of the mouth is the same as that covering the outside of the face, though its appearance is changed by being constantly bathed in saliva.

The surfaces of the throat, nose, air passages, stomach and intestines, as well as those of all parts of the body exposed outwardly, have the same kind of covering. It is called epithelium.

Our hair and nails, the feathers of birds and the enamel of teeth are all formed from the epithelium

of the skin that has dipped downward to be changed into them.

Around the roots of the hairs, imbedded in the skin, we find little oil wells, called sebaceous glands, which, when the skin is properly cared for by bathing and the avoidance of too much heating-food, furnish the means to keep the hair pliable and the skin soft. When they become stopped up from lack of exercise and improper feeding, we get blackheads, red blotches and pimples on our faces.

The sebaceous glands are not shown in the plate, but they consist of little sacs opening out at the side of the follicle (or depression of the skin in which the hair grows) just below the place of exit of the hair.

If we eat too much heating-food, such as candy, sugar, bread and butter or cake and heavy food, like beans, and take very little exercise, a whole lot of bad things will happen. Besides getting pimples on our faces, our gums and the skin of the mouth becomes swollen and sore, and our teeth decay very rapidly.

All of this may be avoided in the great majority of cases if we eat the proper kind of food, and take regular exercise in the open air. Exercise stimulates the flow of blood to all parts of the body; the blood carries food material to them, and takes away waste matter .

CHAPTER V.

THE BRAIN AND NERVOUS SYSTEM.

Everything that takes place within our bodies, every move that we make, everything that we see, hear, smell, feel or taste, is under the control of a wonderful nervous system whose central station is the brain.

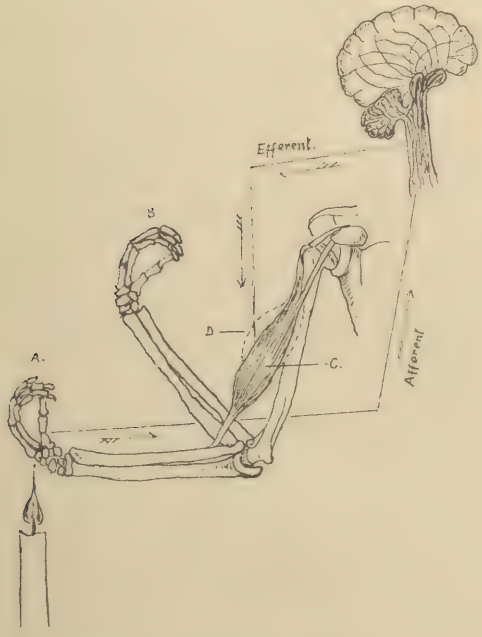
The brain is situated in the top and back of the head within the skull. It consists of three main parts; the right and left hemispheres of the cerebrum, occupying the space on top and to the front, and the cerebellum situated in the back at the base of the skull. The brain is joined to the spinal cord (to which we will refer later) by the medulla oblongata. Many pairs of nerves branch out from the medulla oblongata and it is believed to be the place from which the actions of breathing and swallowing are controlled, and to contain the chief vaso-motor centre of our body, i.e. that from which influences go out that control the action of the blood-vessels. The cerebellum is believed to be the seat of control over voluntary muscular action. The cerebral hemispheres are the organs of mind; the two sides usually act as one.

TOUCH.

The entire surface of our body when healthy possesses the sense of touch. Deep seated organs within the body do not possess this sense. Susceptibility to pain is a different thing from sense of touch. Under an anaesthetic, one does not know pain, but feels every movement made.

The under layer or true-skin of the hand has

rows and rows of little points called papillae, each of which contains a loop of capillary blood-vessels and a nerve ending. These nerve ends convey the impression of touch to other nerves and from them it passes into the spinal cord and up to the brain. If you had touched your hand to a hot stove, an impression would be carried to the brain, where it would be known that the hand was in danger. An order would then be sent out over another nerve to muscles that move the hand and arm, and by their contraction the hand would be moved away from the heat. That to and from action constitutes what is called reflex action.



Diagram—Illustrating Reflex Action

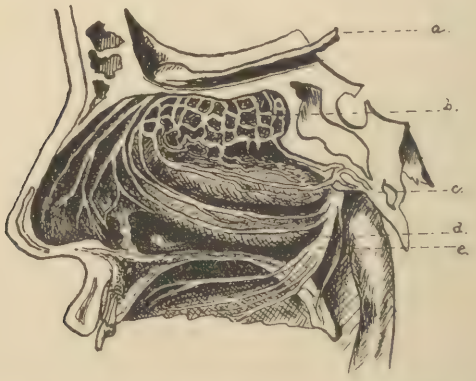
TASTE.

On the tongue and on the soft palate are located the organs of taste. Little red dots may sometimes be seen on the surface of the tongue. They are papillae composed of groups of cells that receive endings of the taste nerves.

The sense of taste may be cultivated to a high degree of delicacy by constantly striving to detect delicate flavors, or dulled by the practice of eating highly seasoned food. The use of the sense of taste is to give pleasure in eating and drinking, thus stimulating the glands that secrete the digestive juices, and to guide us in the selection of food.

SMELL.

The seat of the sense of smell is in the upper third of the nose cavity. Through the lower two



Drawing—Showing the Interior of the Human Nose
Longitudinal Section

thirds, the air passes in breathing; this part is so constructed that the air is warmed and moistened as it

passes through it, and many solid particles are prevented from entering the lungs. Each of these divisions is covered by a distinct kind of membrane; that of the upper part has an outer coat or epithelium composed of two kinds of cells, columnar and rod. To the latter are joined the ends of the smelling nerves that convey the sensation to the brain.

HEARING.

When we strike a bell or blow a trumpet, it trembles or vigrates very rapidly. These vibrations produce waves in the air which travel alone until they strike nerves in our ears and then we get the knowledge of sound. Hearing is the ability to know these sounds. Rapid short waves produce high or shrill sounds; slow long waves produce low or grave ones, whether they come from a bell, a trumpet or the human voice.

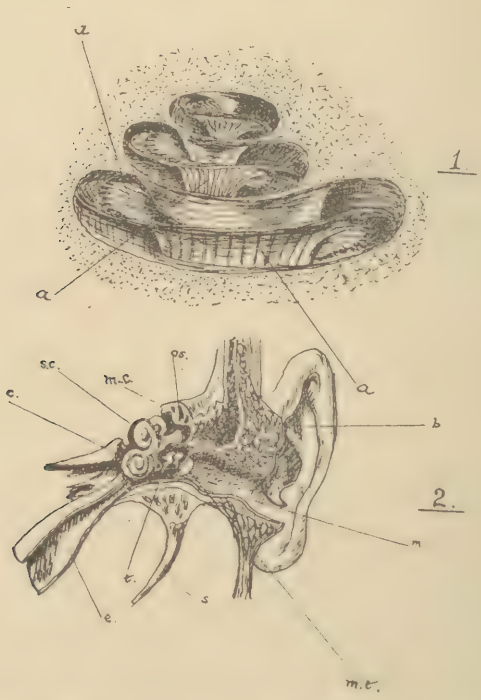
THE EAR.

The ear is the organ of hearing. It is composed of an outer, a middle and an inner part. The part that we see is the outer ear. It collects the sound waves, which then pass in and strike upon a membrane called the membrana tympani.

On the other side of this membrane is the middle ear or drum. In it are three small bones called malleus (hammer), incus (anvil) and stapes (stirrup). The handle of the hammer lies against the inner side of the membrane, just as the needle of th graphophone touches the record, and is moved when the air waves strike the outside of the drum.

These movements are passed along through the three small bones that are hinged together, just as vibration are carried away through the needle of the graphophone, until they reach the opening into the inne. ear. The inside of the inner ear looks like a spiral staircase, and delicate nerve ends are spread

out all over the stairs. These collect the sounds and through a nerve called the auditory, or hearing nerve, they are carried to the brain. The brain is taught to know them one from another.



Drawings—Showing the Outer, Middle, and Inner Ear

VISION.

When light rays collected on a surface sensitive to them are conveyed by an optic nerve to parts of the brain specially made to receive them, we have the sense of sight.

The principal organs of sight or vision are the eyes. They are located one on each side of the face. Passing backward from each eye-ball is an optic nerve that unites with and crosses its opposite at a point a short distance back of its insertion in the eye-ball. The optic nerve is made up of a number of fibres forming bundles. At the point where the bundles cross, some fibres pass directly over to

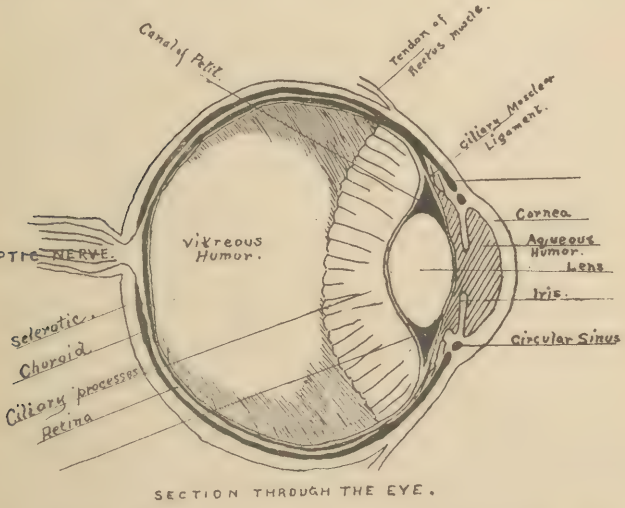


Diagram of the Human Eye— Longitudinal Section

the other eye, some cross over from the right eye and enter the brain through the left optic nerve bundle, and vice-versa, and some go directly through on the side from which they start.

In the middle of the eye in the front is an opening through which the light rays go; it is called the pupil; around it is a colored ring called the iris; it may be blue, gray or brown, or mixtures of these. If we go into a dark room, the opening becomes

wider to let in more light; then if we go towards the light again, it becomes smaller; thus protecting the eye from injury that would come from too much light striking its sensitive interior surface called the retina which is made to receive light-rays, and to deliver them to the optic nerve through small endings that reach to all parts of the retina. In front of the retina and behind the opening is a lens through which the rays of light pass before striking the retina. The lenses of different eyes are not alike. Their shape changes at different ages and from the effects of sickness and overwork, bad light, and sitting in the wrong position when reading or studying, and then we have to wear glasses to help us see correctly. Sometimes the changes affect the eyes so that we cannot see near things clearly, and then they say we are far-sighted; sometimes we cannot see things unless they are held very close to the eye; that is called being near-sighted. Both of these conditions may be corrected by having proper glasses fitted to the eyes.

CRANIAL NERVES.

The nerves conveying these sensations to the brain, belong to a set of twelve called cranial or head nerves. They are named as follows:

1. Olofactory
2. Optic
3. Motor oculii
4. Patheticus or Trochlearis
5. Tri-geminus
6. Abducens
7. Facialis
8. Acusticus
9. Glosso-pharyngeus
10. Pneumogastric or Vagus
11. Spinal accessory or Accessorius
12. Hypoglossus

The olofactory, optic and acusticus are called nerves of special sense. The others are either nerves of common sensation which go to the teeth, different parts of the face, throat and tongue; or motor nerves, which go to the muscles that move the eyelid, the eyeball, the cheeks, jaw and tongue. Some branches of these are mixed nerves, that is, both sensory and motor. They go to the surface of the stomach, and to the air passages of the lungs.

SPINAL NERVES.

The back bone, or spinal-column, is composed of a number of flat segments of bone with branching bones, or spurs, sticking out from them at the back. Through each segment is a large opening. They are separated from one another by cushions of cartilage, a substance not so hard as bone, and firmly connected by ligaments, thus providing for some degree of movement; so that we are able to sway our bodies backward and forward, and to either side. When these bones are joined together forming the spinal column, the openings are opposite one another, thus forming a long canal to hold the spinal cord. This, you will remember, is joined to the brain by the medulla oblongata. It is described as consisting of two anterior and two posterior divisions or columns.

CENTRAL NERVOUS SYSTEM.

The brain and spinal cord together form what is known as the "central nervous system." This controls everything that the body does—breathing, walking, thinking, talking, smelling, hearing, seeing,—and its growth and repair.

Through side openings in each of the bones of the spinal column, bundles of nerve fibre which are continuous with others in the spinal cord, pass; they are called roots. Two entering the posterior

columns of the cord and are called dorsal roots; two leaving the anterior columns of the cord are called ventral roots. On each of the back or dorsal is a ganglion or cluster of cells from which nerve fibres branch out. They are called afferent nerve fibres and convey sensations such as those of heat, cold or pain to the cord; these pass up through the cord until they reach some particular place in the "central system" that looks after that part of the body where the sensation was felt. An order is there formed that goes down through another set of nerves in the spinal cord and out through a ventral root by means of an efferent nerve to the skin, muscle, gland or other part from which the impression of heat, cold, taste, pain or other sensation came. If you had happened to put your hand on a hot stove, the order would go to muscles that move the arm; they would then contract and pull your arm and hand away from the stove.

The word afferent means to carry to,
The word efferent means to bring away.

The combined action of the afferent, central nervous system and the efferent nerves is called REFLEX ACTION and it is this that controls every function of our body. If something should get in our throat, we cough; if something tickles the mucous membrane of the nose, we sneeze; both are examples of reflex action.

THE END.

The Authorities drawn on in this book are:

The U. S. Department of Agriculture Bulletins.

Osler's Modern Medicine.

An American Text-Book of Physiology,—Howell.

Conspectus of the Medical Sciences,—Hartshorne.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